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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/065,711	11/12/2002	Ching-Yu Chang	JCLA9374	4262

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EXAMINER

BARRECA, NICOLE M

ART UNIT PAPER NUMBER

1756

DATE MAILED: 11/15/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/065,711

Applicant(s)

CHANG, CHING-YU

Examiner

Nicole M Barreca

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 September 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-12 and 14-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-12 and 14-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 November 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-12, 14-20 are pending in this application.

Response to Amendment

2. The previous rejections over Adair and Hwang have been withdrawn in response to the applicant's amendments. However please note that a new rejection using a different embodiment of Adair has been applied.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 10-12, 14, 15 are rejected under 35 U.S.C. 102(b) as being anticipated by Adair (US 5,959,325).
5. The first photoresist layer 140 is exposed and developed in order to define the desired features as shown in Figure 5. The features are lines running in a first direction and as can be seen in the figure, are not all the same lengths. The photoresists may be negative or positive. The second layer of photoresist 150 is deposited, exposed and developed to form the structure as illustrated in Figure 7, wherein the lines are orthogonal to the direction of the lines exposed in the first photoresist. It can also be

seen from Figure 7 that the lines of the second photoresist are arranged regularly and this results in a final pattern of irregularly distributed rectangular openings (col.7, 26-62).

6. Claims 1, 2, 7, 8 are rejected under 35 U.S.C. 102(e) as being anticipated by Chang (US 6,689,663).

The applied reference has a common inventor and assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

Figure 5 illustrates a mask ROM array on a semiconductor substrate having a plurality of orthogonally arranged bit lines 11 and word lines 12, which in combination form memory cells 15. The bit lines are formed before the word lines (col.7, 11-52). A first photoresist 28 is formed and may be negative (col.8, 42-60). The first photoresist is exposed to UV light and developed to form the pre-code pattern of all memory cell 15 windows available for coding (col.9, 1-16). A second layer of photoresist 31 is spun on the hardened first photoresist and may be positive. The second photoresist is exposed to UV light and developed to form the real-code openings at a different orientation than the first pattern. Regions 39, corresponding to the both the pre-code openings of the first photoresist and the real-code openings of the second photoresist remain exposed for subsequent coding implantation (col.9, 50-col.10, 26).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 1-5, 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Adair in view of Choi (US 5,650,956).

9. The teachings of Adair have been discussed above. Adair uses the mask patterns to form a memory device such as DRAM and does not disclose using the patterns to form a mask ROM wherein the substrate comprises buried bit lines and word lines. Choi teaches that it is well known in the art semiconductor memory devices having a cell array in which a plurality of bit and word lines which are crossed to each other, such as DRAM, SRAM and mask ROM may be effectively manufactured using the same techniques (col.8, 48-55). It would have been obvious to one of ordinary skill in the art to use the patterning method of Adair to manufacture a MROM instead of a DRAM because Choi teaches that it is well known in the art that memory devices such as DRAM, SRAM and mask ROM may be effectively manufactured using the same techniques.

10. Claims 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chang or Adair in view of Choi as applied to claim 1 above, and further in view of Furukawa (US 6303272).

11. The references individually teach a patterning method for forming orthogonal patterns using two photoresist layers with separate exposure and development steps. The references do not disclose exposing the photoresists to off-axis illumination. Furukawa also teaches a patterning method for forming orthogonal patterns using two photoresist layers, exposed and developed in two separate steps. Such orthogonal features may also be exposed using conventional off-axis illumination in order to further enhance the resulting image (col.5; 25-37). It would have been obvious to one of ordinary skill in the art to expose the photoresist layers to off-axis illumination in the methods of Chang or Adair in view of Choi because Furukawa teaches that these orthogonal features may be further enhanced by exposing the two photoresists layers to conventional image enhancement processes, such as an off-axis illumination.
12. Claims 9 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chang or Adair in view of Choi.
13. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Adair.
14. The references are silent on the size of the square coding window and do not disclose that the coding window is 0.12 microns by 0.12 microns (cl.9). However it is known in the art that the resulting pattern size is a result effective variable dependent on the exposure conditions such as photoresist material, exposure light and photomask pattern size. It would within the ordinary skill of one in the art to determine the optimal coding window size in the method of Chang or Adair in view of Choi by routine experimentation and to have the coding window be 0.12 microns by 0.12 microns, if desired, because it is known in the art that the resulting pattern size is a result-effective

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variable, and the discovery of an optimum value of a result effective variable is ordinary within the skill of the art, as taught by *In re Boesch*, (617 F.2d 272, 205 USPQ 215 (CCPA 1980)). The references disclose trenches having square corners and do not disclose the trenches to have rounded corners (cl.19,20). However one of ordinary skill in the art would recognize that the resultant pattern shape is dependent on the shape of the photomask pattern used for exposure and could have adjusted the first photomask pattern in the disclosed methods if it was desired for the first line/space pattern to have rounded corners.

15. Claims 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Adair as applied to claim 10 above, and further in view of Ng (US 5876903).

16. Adair does not disclose hardening the photoresist by implanting Ar or N₂ ions with a dosage of about 1×10^{14} to about $3 \times 10^{15}/\text{cm}^2$ at an energy of about 2 to about 50 KeV. Ng teaches a method for hardening a photoresist layer, which allows the photoresist pattern to withstand subsequent exposure to etchants and other chemicals. A typical ion implantation would comprise implanting Ar ions at $1 \times 10^{15}/\text{cm}^2$ at an energy of about 40 KeV (col.4, 35-46). It would have been obvious to one of ordinary skill in the art to harden the first photoresist pattern by implanting Ar or N₂ ions with a dosage of about 1×10^{14} to about $3 \times 10^{15}/\text{cm}^2$ and an energy of about 2 to about 50 KeV in the method of Adair because Ng teaches that hardening a photoresist by ion implantation, such as by implanting Ar ions at $1 \times 10^{15}/\text{cm}^2$ at an energy of about 40 KeV, will allow the photoresist pattern to withstand subsequent exposure to etchants and other chemicals.

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17. Claims 16 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Adair as applied to claim 10 above, and further in view of Furihata (US 5618892).

18. Adair does not disclose baking the first photoresist at a temperature from about 100-150 °C at about 30-180 seconds. Furihata teaches that a typical post-exposure bake of a negative photoresist exposed at 248 nm is at a temperature of about 80-130 °C for about 1-5 minutes (col.6, 33-41). It would have been obvious to one of ordinary skill in the art to perform the post-exposure bake of the first photoresist pattern at a temperature of about 100-150 °C for about 30-180 seconds in the method of Adair because Furihata teaches that a typical PEB process for a negative photoresist is at a temperature of about 80-130 °C for about 1-5 minutes.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nicole M Barreca whose telephone number is 571-272-1379. The examiner can normally be reached on Monday-Thursday (9AM-7PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Nicole M Barreca
Examiner
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A handwritten signature in cursive script, appearing to read "Nicole Barreca", written in black ink.

11/8/04